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Indian Standard

RECOMMENDATIONS FOR USE OF POLYETHYLENE FILM FOR WATERPROOFING OF ROOFS

(First Revision)

Second Reprint FEBRUARY 1999

UDC 678·742·2·416 : 699·82 : 69·024·15

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MANAK BHAVAN, 19 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

May 1980

Gr 4

Indian Standard

RECOMMENDATIONS FOR USE OF POLYETHYLENE FILM FOR WATERPROOFING OF ROOFS

(First Revision)

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AMENDMENT NO. 1 NOVEMBER 2000
TO
IS 7290 : 1979 RECOMMENDATIONS FOR USE OF POLYETHYLENE FILM FOR WATER-PROOFING OF ROOFS

(First Revision)

(*Page* 8, *clause* 7.2.4) — Insert the following after last sentence:

'Quantity of primer shall be 0.27 l/m^2 *Min.*'

(CED 41)

Reprography Unit, BIS, New Delhi, India

Indian Standard

RECOMMENDATIONS FOR USE OF POLYETHYLENE FILM FOR WATERPROOFING OF ROOFS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 25 October 1979, after the draft finalized by the Waterproofing and Damp-Proofing Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Polyethylene film is one of the materials which are being used for waterproofing of roofs of buildings. The experience gained so far indicates that when polyethylene film is laid on the roof as recommended, the treatment provides satisfactory performance against water penetration. In order to efficiently protect the roof of a building against water penetration, it is important that the waterproofing treatment using polyethylene film should be carefully carried out from the time the roof surface is prepared to receive the treatment to the finishing of the treated surface. Special care should be taken to ensure effective bonding of the polyethylene film to the background surface as well as in the overlaps. Proper precautions should be taken against puncturing of the polyethylene film and entrapping of air while laying the waterproofing treatment.

0.2.1 This standard was first published in 1973. The present revision incorporates changes based on the experience gained in the use of the standard and some important changes relating to the application of bitumen over the polyethylene film. A few changes in the various figures consequent to the above have also been incorporated.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

---

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard provides recommendations for the laying of polyethylene film for waterproofing of roofs.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Bonding Material — Bitumen and/or bituminous compositions used to bond a layer of polyethylene film to the roof surface, or one layer of polyethylene film to another and for the top dressing.

2.2 Layer — A single layer of polyethylene film of specific film thickness.

3. GENERAL

3.1 For efficient planning, design and laying of the waterproofing treatment, the basic information, design considerations and preparation of roof surface shall be as given in IS : 3067-1966*.

4. MATERIALS

4.1 Polyethylene Film — Polyethylene film shall conform to IS : 2508-1977†. In addition the film shall also satisfy the following conditions:

a) The film may be natural or black in colour. The black film shall contain not less than 2·0 percent of carbon black of an average particle size not exceeding 0·06 micron, well dispersed in mass. The natural film shall be of ultra-violet stabilized quality only.

b) Water vapour transmission through the film determined by the procedure described in Appendix A shall not be more than 5·53 g/24 h/m^2.

4.2 Bonding Materials — These materials shall consist of straight-run bitumen grades conforming to IS : 73-1961‡. Over the film a cold cutback of bitumen conforming to IS : 73-1961‡ may be used. The temperature of cutback bitumen shall be not more than 50°C at the time of application.

---

*Code of practice for general design details and preparatory work for damp-proofing and waterproofing of buildings.

†Specification for low density polyethylene film (*first revision*).

‡Specification for paving bitumen (*revised*).

4.3 Bitumen Primer — Primer shall conform to IS : 3384-1965*.

5. PREPARATION OF ROOF SURFACE

5.1 Prior to the laying of the waterproofing treatment, the roof surface shall be prepared according to **6.2** of IS : 3067-1966† in order to obtain as smooth a surface as possible.

6. TYPES OF WATERPROOFING TREATMENT

6.1 Pre-sloped Roofs — The types of treatment given in **6.1.1** and **6.1.2** are recommended.

6.1.1 *Single Layer Treatment*

6.1.1.1 *Treatment laid over the thermal insulation (see Fig. 1).*

NOTE — Whenever expanded polystyrene foam concrete and such other materials are used for the insulation, the waterproofing treatment shall be laid on the top of the insulating material and the insulating material shall be protected by a layer of 15 mm thick cement plaster prepared by mixing cement and sand in the ratio of 1 : 6 or lime mortar 1 : 3.

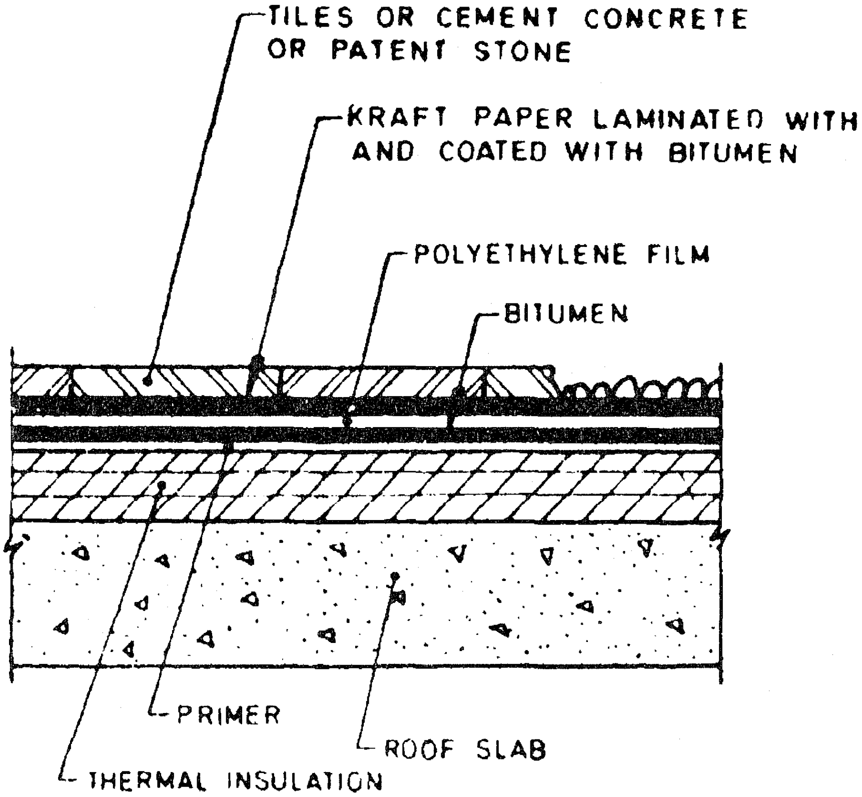
TILES OR CEMENT CONCRETE OR PATENT STONE
KRAFT PAPER LAMINATED WITH AND COATED WITH BITUMEN
POLYETHYLENE FILM
BITUMEN
PRIMER
ROOF SLAB
THERMAL INSULATION

FIG. 1 SINGLE LAYER FILM TREATMENT OVER THE THERMAL INSULATION ON THE ROOF

---

*Specification for bitumen primer for use in waterproofing and damp-proofing.

†Code of practice for general design, details and preparatory work for damp-proofing and waterproofing of buildings.

a) *Film treatment when finished with plaster or gravel*

1) Where necessary, primer may be applied to the prepared surface at 0·3 to 0·5 kg/m^2, till the surface is properly impregnated and the solvent oil in the primer shall be allowed to evaporate completely.

2) Hot applied bitumen (straight-run bitumen conforming to IS : 73-1961*) at the rate of 0·70 kg/m^2, minimum.

3) Polyethylene film with cold cutback adhesive in overlaps.

4) Cold cutback of bitumen at the rate of 1·0 kg/m^2, minimum over the film.

5) Blinding materials, such as fine sand in dry condition, at the rate of 0·5 to 1 kg/m^2 may be dusted over the bitumen in (4) above.

6) Finishing layer, such as gravel on the flat surface and cement plaster 1 : 6 or lime mortar 1 : 3 on all vertical faces. OR Cement plaster 1 : 6 or lime mortar 1 : 3 on the entire treated area [*see also* **7.2.5** (g)].

NOTE — Where pea gravel grit finish is required the size of the gravel should be 3 to 6 mm properly impregnated/embedded at 0·006 m^3/m^2.

b) *Film treatment when finished with tiles or patent stone or cement concrete*

1) Where necessary, primer may be applied to the prepared surface at 0·3 to 0·5 kg/m^2, till the surface is properly impregnated.

2) Hot applied bitumen (straight-run bitumen conforming to IS : 73-1961*) at the rate of 0·70 kg/m^2, minimum.

3) Polyethylene film with cold cutback adhesive in overlaps.

4) 100 g brown kraft paper laminated *in situ* over the film with semi-hot layer of straight-run bitumen. The technique of fixing kraft paper to polyethylene film is to paint semi-hot bitumen on the paper, reverse it and laminate over the film.

5) Semi-hot applied bitumen (straight-run grade conforming to IS : 73-1961*) at the rate of 0·7 kg/m^2 dusted with fine sand.

6) Finishing layer of tiles or patent stones or cement concrete.

6.1.2 *Multi-layer Treatment* — In severe conditions of exposure, such as heavy rainfall, high roofs or important structures it is advisable to provide multi-layer treatment. Normally, 2-layer treatment is sufficient to obtain adequate resistance to rain penetration.

---

*Specification for paving bitumen.

a) *Lower layer* — Film treatment as given in **6.1.1.1** (b) (1) to (4).

b) *Upper layer* — Repeat treatment as given in **6.1.1.1**(a) (2) to (5) or **6.1.1.1**(b) (2) to (5) depending upon the choice of finishing layer.

6.2 Unsloped Roofs in Mud *PHUSKA*

6.2.1 *Treatment Laid Below Lime Terracing or Mud PHUSKA* (*see Fig.* 2)

a) *Film treatment finished with mud PHUSKA* — as given in **6.1.1.1**(a) (1) to (5) or **6.1.1.1**(b) (1) to (5) and protective treatment, such as mud PHUSKA in slope (*see* IS : 2115-1967*) and one or more layers of burnt clay tiles.

b) *Film treatment finished with lime terracing* — as given in **6.1.1.1**(b) (1) to (5) and protective treatment, such as lime terracing in slope.

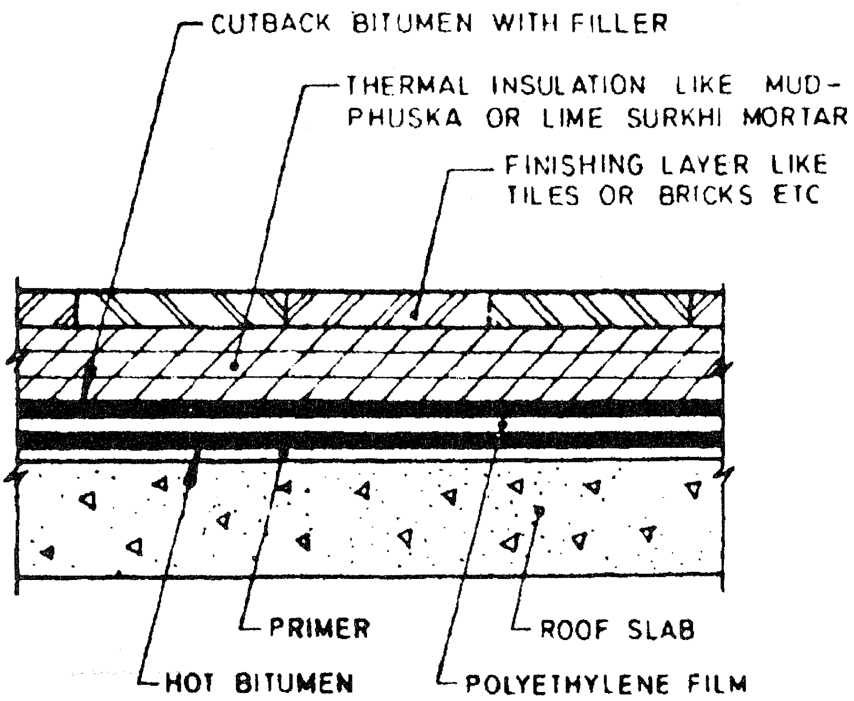
CUTBACK BITUMEN WITH FILLER
THERMAL INSULATION LIKE MUD-PHUSKA OR LIME SURKHI MORTAR
FINISHING LAYER LIKE TILES OR BRICKS ETC
PRIMER
ROOF SLAB
HOT BITUMEN
POLYETHYLENE FILM

FIG. 2 TREATMENT LAID BELOW THERMAL PROTECTION

---

*Code of practice for flat-roof finish : mud *PHUSKA*.

7. METHOD OF LAYING

7.1 Sequence of Operation — The sequence of operation for all types of treatment shall be as follows:

a) Preparation of the surface including clearing of roof surface of all foreign materials (*see* IS : 3067-1966*),

b) Laying of treatment on roofs and provision of flashings,

c) Treatment of gutters and drain mouths,

d) Surface finishing, and

e) Cleaning and removal of surplus materials.

7.1.1 Throughout the laying operations, care shall be taken to avoid puncturing of the polyethylene film.

7.2 Laying

7.2.1 The number of laps shall be minimized by selecting film of suitable width and laying it as specified in **7.2.2** to **7.2.6**. The minimum width of laps shall be 10 cm between adjacent films and at the ends.

7.2.2 The primer shall be applied on the prepared roof surface by brushing and allowing to dry for 6 to 12 hours.

7.2.3 The hot bitumen shall be spread on the roof surface and allowed to cool to a temperature so that the film may be laid without any damage to it.

7.2.4 The polyethylene film shall be carefully laid on the bituminous layer and firmly but carefully pressed down with the help of a gunny cloth so as to prevent any damage to the film.

7.2.4.1 The next length of the polyethylene film shall be similarly laid down on the roof with proper longitudinal and end overlaps, and firmly pressed on the bituminous layer. The joints and overlaps shall be carefully sealed with the help of cutback bitumen applied over the upper surface of lower layer of polyethylene film.

7.2.4.2 As far as possible, the polyethylene film shall be laid down as follows:

a) *Flat roofs* (*see Fig.* 3A) — at right angles to the direction of flow of water with the overlap facing downwards.

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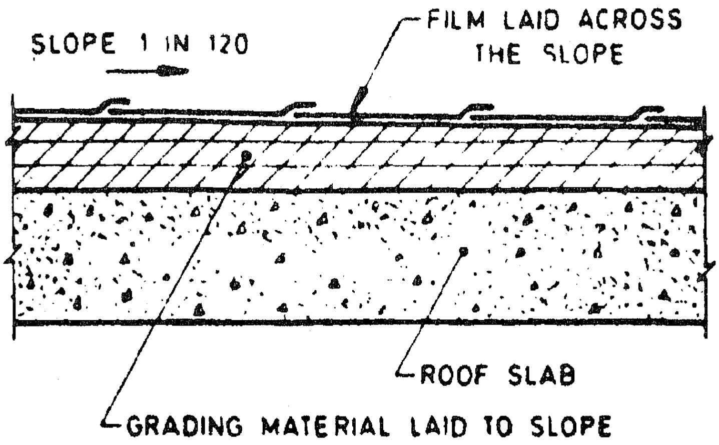
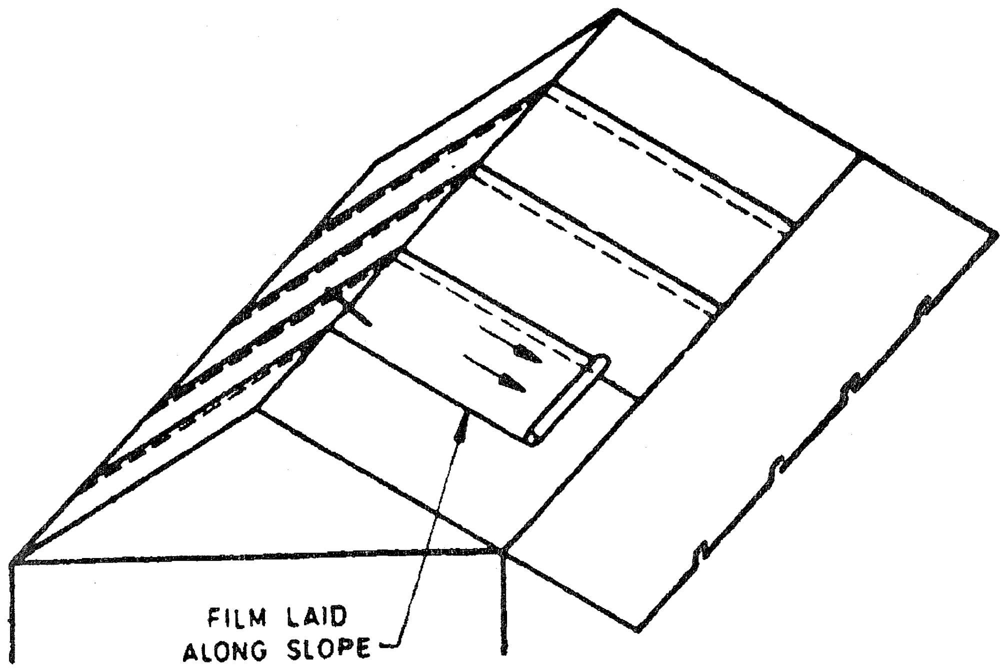
*Code of practice for general design details and preparatory work for damp-proofing and waterproofing of buildings.

b) *Sloping roof* (*see Fig.* 3B) — successive layers laid along the slope.



3A FLAT ROOF

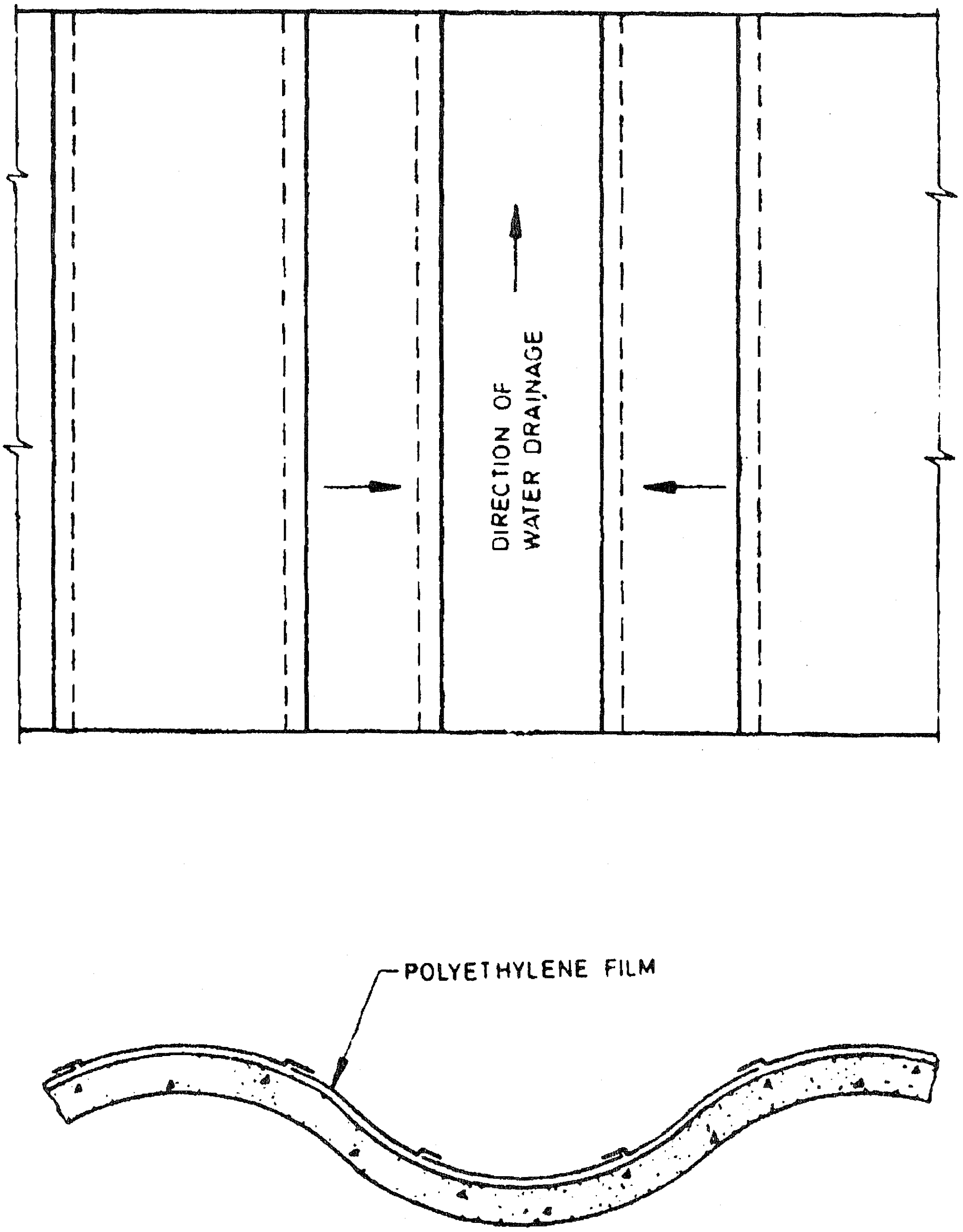


3B SLOPING ROOF

FIG. 3 TYPICAL ARRANGEMENT FOR LAYING POLYETHYLENE FILM

(*Continued*)

c) *Curved shell roof* (*see Fig.* 3C) — across the slope in order to avoid excessive laps in the trough portion.



3C SHELL ROOF

Fig. 3 Typical Arrangement for Laying Polyethylene Film

7.2.4.3 As far as possible, laps shall be avoided in the troughs or valleys. Where unavoidable, they shall be covered by an additional film strip of adequate width.

7.2.5 In laying film treatment, following precautions should be observed:

a) The surface should be reasonably smooth so as to avoid puncturing of the film. The primer should not be laid on wet surface.

b) Excessive bitumen should not be used for bonding the film to the prepared surface, which may otherwise result in the film sliding and wrinkling.

c) It is necessary to avoid overstretching of the film at the time of laying, which otherwise leads to wrinkles when the film retracts. These wrinkles may get reproduced in the final treatment and are liable to get eroded and cause failure for treatment.

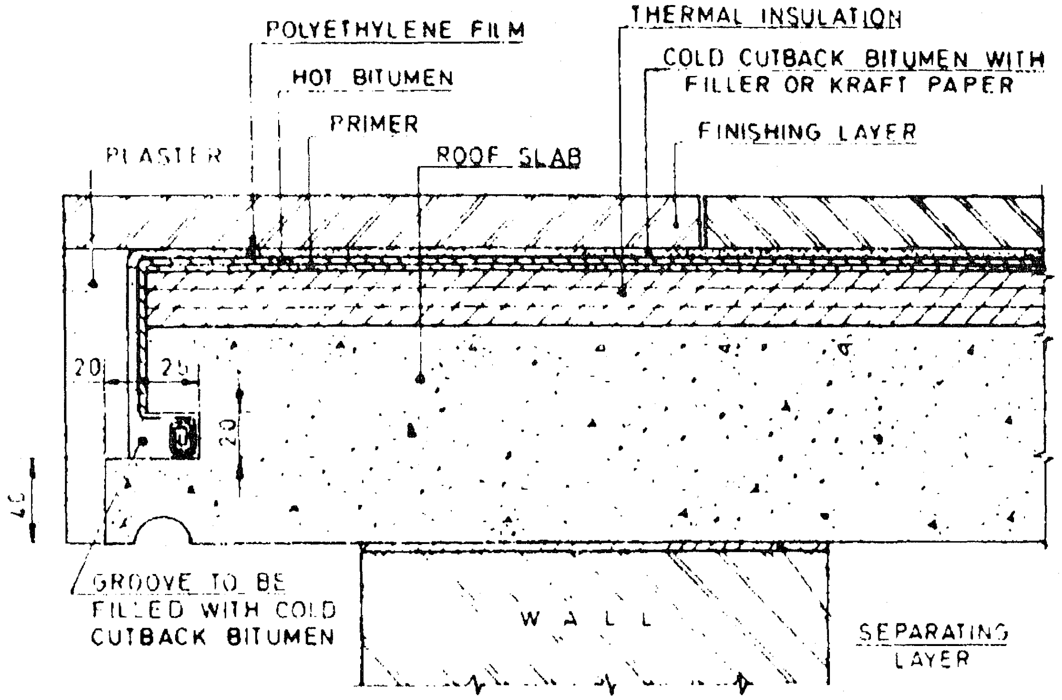
d) The laying of the film should be immediately followed by subsequent operations of covering with bituminous compositions. It is found that if the film is left exposed, it can lead to softening of bitumen layer underneath causing wrinkles, which may possibly lead to damage. The work should, therefore, be not carried out when the temperature is high.

c) It is necessary to hold the film high and finally pressed in position by cloth pad, so that the film sets securely on bituminous underlay. Otherwise, this will result in the formation of air bubbles below the film, which will lead to poor bonding.

f) The workmen should preferably walk barefooted or with canvas shoes in order to prevent damage to the film.

g) Wherever polyethylene film is to be carried over from horizontal to vertical surface, it should be over a fillet and protected with cement plaster or any other treatment. This applies to the portions of the structures, such as corners, gutters, junctions, parapets and all verticle faces.

7.2.6 Typical details of the treatment in case of roofs projecting beyond the wall, junctions of roof with parapet walls and roof with projecting features are shown in Fig. 4 to 6. The purpose of adopting these details is to ensure that the moisture does not find its way through an unguarded weak link in the completed treatment. Composite polythene bitumen tapes may be used to simplify treatment on complicated joints.



All Dimensions in Millimetres.

FIG. 4 TYPICAL DETAIL OF WATERPROOFING TREATMENT IN CASE OF ROOF PROJECTING BEYOND THE WALL.

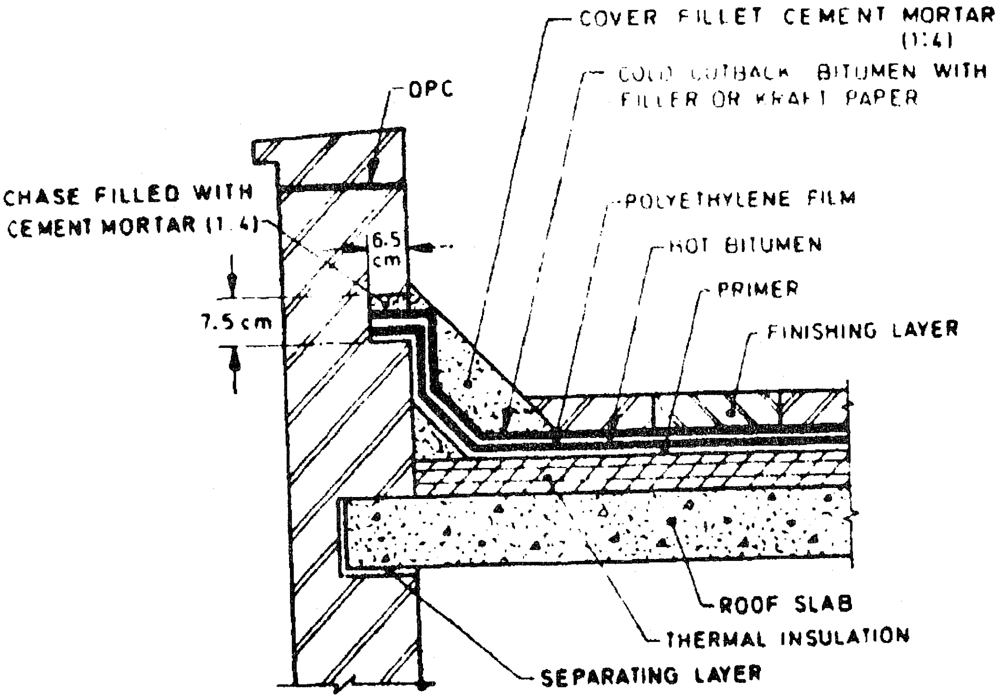

COVER FILLET CEMENT MORTAR (1:4)
COLD CUTBACK BITUMEN WITH FILLER OR KRAFT PAPER
OPC
CHASE FILLED WITH CEMENT MORTAR (1:4)
6.5 cm
7.5 cm
POLYETHYLENE FILM
HOT BITUMEN
PRIMER
FINISHING LAYER
ROOF SLAB
THERMAL INSULATION
SEPARATING LAYER

FIG. 5 TYPICAL DETAIL OF WATERPROOFING TREATMENT IN CASE OF ROOFS ABUTTING AGAINST THE PARAPET WALL.

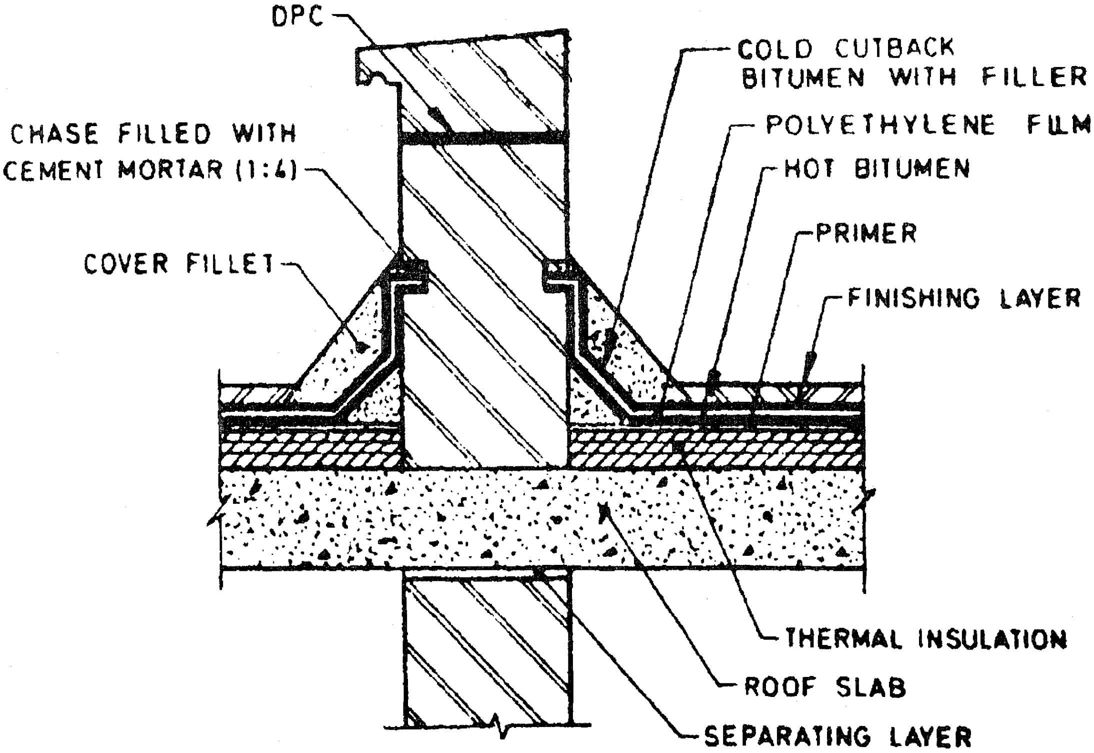


FIG. 6 TYPICAL DETAIL OF WATERPROOFING TREATMENT FOR ROOF WITH PROJECTING FEATURES

7.2.6.1 Where parapets exist and downtake water pipes are provided to drain off the rain-water, extra piece of polyethylene film shall be provided in the opening covering the edge of the water pipe and covered with cement plaster 1 : 6.

8. INSPECTION AND MAINTENANCE

8.1 It is recommended that arrangements shall be made for a detailed inspection of the waterproofing treatment periodically, preferably prior to the advent of the rainy season with a view to repairing any defects and ensure complete waterproofing.

APPENDIX A

[*Clause* 4.1 (b)]

METHOD OF TEST FOR MEASURING WATER VAPOUR TRANSMISSION OF POLYETHYLENE FILM

A-1. SCOPE

A-1.1 This method of test covers the procedure for measuring water vapour transmission of polyethylene film.

A-2. APPARATUS

A-2.1 Test Dishes — Open mouth dishes of such size or shape that can be accommodated readily on the pan of an analytical balance. The dishes shall be constructed from a non-corroding, non-permeable material, and shall be as light as is consistent with the necessary rigidity. The area of the opening shall be at least 30 cm^2. The test dishes shall be of such design that the test specimens can be sealed over the opening of the dishes in such a manner that their exposed area is well defined on both sides, and that no leakage of water vapour can occur at or through the edges of the specimens. The exposed area of the specimens shall be equal to the area of the desiccant in the dish. There shall be no obstructions within the dish that would restrict the flow of water vapour between the specimen area and the water or desiccant in the dish.

A-2.2 Balance — Analytical balance of such capacity and sensitivity that the weight changes to be measured can be determined to within one percent.

A-2.3 Desiccant — Desiccant, such as anhydrous calcium chloride having a high affinity for water vapour and a high drying efficiency, that is, giving a low water vapour pressure after absorbing a large amount of water. The desiccant shall remain essentially unchanged in physical condition and exert no chemical or physical action other than dehydration effects on test specimen with which it is in contact.

A-2.4 Test Chamber — A test room or cabinet provided with circulating air maintained at 38 ± 0·5°C and 90 ± 2 percent relative humidity. Suitable racks shall be provided to place the test dishes in the circulating air stream in the chamber.

A-2.5 Weighing Covers — Weighing covers for the test dishes shall be provided if the dishes have to be removed from the test room or cabinet for weighing.

A-2.6 Template — A template may be used for defining the test area and effecting the wax seal.

A-3. TEST SPECIMENS

A-3.1 Four specimens shall be tested, two being attached to the dish with a designated side out, and the other two with the opposite side out, unless otherwise specified. Great care shall be taken not to contaminate the test area of the specimen.

A-4. PROCEDURE

A-4.1 Place the desiccant to a depth of at least 15 mm in the dish. Seal the specimen to the opening of the dish in such a manner that leakage of water vapour at and through the edges is prevented.

A-4.2 Weigh the assembly and place it on a rack inside a test chamber (*see* **A-2.4**) in an inverted position so that the desiccant is in direct contact with the test specimen, and so located that the conditioned air circulates over the exposed surface of the specimen with the specified velocity.

A-4.3 Make successive weighing of the assembly at suitable intervals until a constant rate of gain is attained. If it is necessary to remove the assembly from the test chamber for weighing, the weighings shall be made immediately after removal, and the assembly shall be returned to the test chambers immediately after each weighing. For specimens that are relatively previous, the weighings shall be frequent enough to complete the test before the efficiency of the desiccant is appreciably reduced.

NOTE — The use of weighing covers is recommended since weighings will have to be made in a room whose humidity and temperatures will differ from the conditions in the cabinet.

A-5. CALCULATION

A-5.1 Calculate the water vapour transmission of the specimen from the rate of gain or loss found in the straight line portion of the plot of weighings *versus* time, as follows:

$$\text{Water vapour transmission, in g/24 h/m}^2 = \frac{G \times 24}{t \times a}$$

where,

G = weight gain or loss, in grams;
t = time, in hours, during which gain or loss, G, was observed; and
a = exposed area of specimen, in m^2.

A-6. REPORT

A-6.1 The report shall include the following:

a) A description of the material tested;
b) Thickness of the sheet on which test was performed;
c) Conditions of test, such as temperature and humidity; and
d) Water vapour transmission, in stated units, under the specified conditions for all the four specimens and their average value.

A-7. REPRODUCIBILITY

A-7.1 Results obtained on different specimens from the same sample shall not differ more than 10 percent from their average.

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